

## PRELIMINARY STUDIES ON THE HAEMOGLOBIN CONCENTRATION IN SOME FRESHWATER FISHES OF IRAQ

by

L.A.J. AL-HASSAN (1) and A.Y. AL-ABOOD (2)

**ABSTRACT.** - The haemoglobin concentration of nine cohabiting teleosts of Hor al-Hammar marsh, Basrah, was carried out. The mean values (g/100 ml) were ranged from 3.2 for *Alburnus sellal* to 9.912 for *Parasilurus triostegus*. The taxonomic consideration of haemoglobin concentration appeared of a little value among the different members of the family Cyprinidae. The mean haemoglobin concentration for *Barbus xanthopterus*, *B. sharpeyi* and *B. grypus* were less than those taken from the same species in other iraqi inland waters. Possible factors that cause a variation in the haemoglobin concentration in fishes were discussed.

**RESUME.** - La concentration de l'hémoglobine de neuf téléostéens du marais de Hor al-Hammar, Basrah, a été mesurée. Les valeurs moyennes (g/100 ml) sont comprises entre 3,2 pour *Alburnus sellal* et 9,912 pour *Parasilurus triostegus*. Du point de vue taxonomique la concentration de l'hémoglobine n'a que peu de valeur parmi les espèces de Cyprinidae étudiées. La concentration moyenne de l'hémoglobine pour *Barbus xanthopterus*, *B. sharpeyi* et *B. grypus* est inférieure à celle mesurée pour les mêmes espèces provenant d'autres régions intérieures de l'Irak. Différents facteurs pouvant entraîner une variation dans la concentration de l'hémoglobine des poissons sont envisagés.

**Key words:** Cyprinidae, Siluridae, *Alburnus sellal*, *Barbus xanthopterus*, *Barbus sharpeyi*, *Barbus grypus*, *Parasilurus triostegus* Iraq, Haemoglobins.

Haematological parameters may, under specific circumstances, provide the fisheries biologists with useful indices of dietary sufficiency, pathological status and physiological response to environmental stress. This was suggested by a variety of studies carried out during the past few years (Houston and DeWilde, 1972; Ezzat *et al.*, 1974; Meade and Perrone, 1980; Wells *et al.*, 1980). Fish blood analyses have faced a considerable effort of development of reliable procedures (Smith and Bell, 1964, 1967). Haemoglobin concentration is considered as one of the haematological parameters that can be readily determined under field or hatchery conditions (Hesser, 1960; Korzheuv, 1962). Controversy still exists regarding the validity of several of the methods which have been used for haemoglobin determination in fish (Larsen and Snieszko, 1961).

Except for the work of Hameed (1980) and Hameed *et al.*, (1985) on some *Barbus* species in the mid region of Iraq, there is no previous work concerning the haematology of the fishes from the iraqi waters. Thus the haematological informations in the present work represent the first of its kind for the freshwater ichthyofauna of Iraq. The aim of the work at hand is to provide preliminary haematological data on some freshwater fishes of Iraq.

---

(1) Dept. of Fisheries & Marine Resources, College of Agriculture, Univ. of Basrah, Basrah, IRAQ.

(2) Dept. of Biology, College of Science, Univ. of Basrah, Basrah, IRAQ.

## MATERIAL AND METHODS

The fishes used in this study were collected from Hor al-Hammar marsh, north of Basrah city (Table I) with a seine net. The study was carried out in March and April 1986.

The blood was drawn into tubes containing EDTA as an anticoagulant either by a heart puncture or by the severing of the peduncle. For small size fish (*Mystus pelusius* and *Alburnus sellal*) the latter method was applied while the former was for the remaining fish species. The haemoglobin concentration per 100 ml of blood was determined by Sahli's haemometer as described by Radzinskaya (1966) and by Pandey *et al.* (1976).

## RESULTS AND DISCUSSION

There were considerable differences in the haematological values of the studied species as in the case of other fishes (Javid and Lone, 1973).

The mean values for the haemoglobin concentration of the nine fish species are given in Table II. Not much variation was observed in the mean value of the haemoglobin concentration for the fish species under consideration. The lowest value was observed in the blood of *Alburnus sellal* and the highest in the catfish, *Parasilurus triostegus*. Within the family Cyprinidae the highest haemoglobin concentration value was observed in the blood of *Barbus sharpeyi* while *Alburnus sellal* blood shows the lowest value.

Variations in the haematological values have been attributed to many factors. Larson *et al.* (1976), disregarding minor variations due to the inaccuracy of analytical methods, divided these factors into two broad groups.

The first group includes those factors which can cause haematological differences in fishes in their natural environment, including age and size of the fish. Das (1965) states that haemoglobin concentration tends to increase with length and age. Similar changes have been observed in many fish species (Siaskpere, 1985). Other factors are spawning season, sex, migration and genetic variation (Atkinson and Judd, 1978).

Table I. Fish species used in the determination of haemoglobin concentrations

Family	Species
Cyprinidae	<i>Barbus sharpeyi</i> <i>B. xanthopterus</i> <i>B. grypus</i> <i>Aspius vorax</i> <i>Cyprinus carpio</i> <i>Alburnus sellal</i>
Bagridae	<i>Mystus pelusius</i>
Siluridae	<i>Parasilurus triostegus</i>
Mugilidae	<i>Liza dussumieri</i>



Table II. Haemoglobin concentration for nine freshwater fish species from Basrah, Iraq.

Species	Range	Mean Hb (g/100 ml)	Range	Mean Hb (%)	Unusual concentration (g/100 ml)
<i>Barbus sharpeyi</i>	4 - 10	7.125 $\pm$ 2.190	39 - 57	44.2 $\pm$ 7.293	26, 60, 64
<i>B. xanthopterus</i>	5.1 - 6.5	5.8 $\pm$ 0.620	32 - 41	36.2 $\pm$ 4.086	-
<i>B. grypus</i>	3.7 - 5.0	4.06 $\pm$ 0.541	24 - 30	25.9 $\pm$ 2.459	-
<i>Aspius vorax</i>	3.2 - 7.0	5.05 $\pm$ 1.835	25 - 43	36 $\pm$ 9.643	20
<i>Cyprinus carpio</i>	5 - 5.8	5.28 $\pm$ 0.327	30 - 35	31.8 $\pm$ 2.049	-
<i>Alburnus sellal</i>	2.8 - 3.6	3.2 $\pm$ 0.565	16.0 - 20.4	18.2 $\pm$ 3.111	-
<i>Mystus pelusius</i>	5.1 - 9.1	8.328 $\pm$ 1.501	47 - 57	55.166 $\pm$ 4.02	32
<i>Parasilurus triostegus</i>	6 - 11.9	9.912 $\pm$ 1.756	62 - 75	66.571 $\pm$ 4.961	37
<i>Liza dussumieri</i>	6 - 6.4	6.266 $\pm$ 0.230	38 - 40	39.333 $\pm$ 1.154	-

The second group that appeared to cause a haematological variation is stress, due to capture, handling and sampling procedures of which capture is most significant (Bouck and Ball, 1966). The previous factors are the major factors that cause a variation in the haemoglobin concentration of fishes and this may explain the high and low haemoglobin concentration obtained from some fish species in the present study (see Table II).

Although there is some variation in the mean value for the haemoglobin concentration between the different members of the family Cyprinidae which might be used as a taxonomic criterion to differentiate between the species of this family, it is appeared that the taxonomic consideration of haemoglobin concentration is of little value. The wide range of factors that appeared to cause variation in haematological parameters which haemoglobin concentration is one of them, makes comparison between the different species is of taxonomic significance. This is evident from the present study where the blood of *Barbus xanthopterus*, *Cyprinus carpio*, and *Aspius vorax* shows more or less similar value in spite that they belong to different genera.

Comparing the haemoglobin concentration for *Barbus sharpeyi*, *B. xanthopterus* and *B. grypus* obtained in the present study with the results obtained by Hameed (1980), it is clear that our results show a lesser value than Hameed (1980). This might be due to the intraspecific variation that might occur between the populations of fish species (Atkinson and Judd, 1978). The haemoglobin concentration of *Mystus pelusius* is within the range described by Javid and Lone (1973) for other species of genus *Mystus*, and also within the range of other silurid fishes (Pandey *et al.*, 1976).

Worthy of note in *Mystus pelusius* and *Parasilurus triostegus* are the high value of the haemoglobin concentration which reflects a high oxygen carrying efficiency of the blood. This is consistent with the correlation of haemoglobin concentration with fish activity and the predatory habit, i.e. the higher is the fish activity the more is the haemoglobin concentration, thus varying physiological requirements are compensated by regulating the levels of the haemoglobin (Siaskpere, 1985). Furthermore, Lenfant and Johansen (1976) have shown that there

is a tendency for haemoglobin concentration to be higher in those fishes which get their oxygen from the air. A high haemoglobin concentration was also observed in the blood of the pelagic mullet *Liza dussumieri*. Thus the present result supports the hypothesis that the pelagic fishes have a higher haemoglobin concentration than the benthic species (Putnam and Freel, 1978).

The haemoglobin concentration of *Cyprinus carpio* obtained in this study is within the range described by other authors for the same species (Black, 1940; Field *et al.*, 1943; Houston and DeWilde, 1971; Fourie and Hattingh, 1976).

In both the inland and marine waters of Iraq, much work still remains to be done before full use can be made of haematological investigations especially building up the normal values together with a full awareness of the environmental and disease factors that may cause a variation in these values.

## REFERENCES

- ATKINSON E. & F.W. JUDD, 1978. - Comparative haematology of *Lepomis microlophus* and *Cichlasoma cyanoguttatum* Copeia, 2 : 230-237.
- BLACK E.C., 1940. - The transport of oxygen by the blood of freshwater fish. *Biol. Bull. mar. biol. Lab.*, Woods Hole, 79 : 215-229.
- BOUCK G.R. & R.C. BALL, 1966. - Influence of capture methods on blood characteristics and mortality in rainbow trout (*Salmo gairdneri*). *Trans. Am. Fish. Soc.*, 95 : 107-176.
- DAS B.C., 1965. - Age-related trends in the blood chemistry and haematology of the Indian Carp (*Catla catla*). *Gerontologia*, 10 : 47-64.
- EZZAT A.A., SHABANZ M.B. & A.M. FARGHALY, 1974. - Studies on the blood characteristics of *Tilapia zilli* (Gervais). I. Blood cells. *J. Fish Biol.*, 6 : 1-12.
- FIELD J.B., ELVEHJEM C.A. & C. JUDAY, 1943. - A study of blood constituents of carp and trout. *J. biol. chem.*, 148 : 261-269.
- FOURIE F.R. & J. HATTINGH, 1976. - A seasonal study of the haematology of carp (*Cyprinus carpio*) from a locality in the Transvaal, South Africa. *Zool. Afric.*, 11 (1) : 75-80.
- HAMEED A.H.M., 1980. - Seasonal changes in some haematological aspects of three species of Iraqi fishes of the genus *Barbus* in Sadat Al-Hindia, M. Sc. Thesis University of Bagdad.
- HAMEED A.H.M. & J.H. JIAD, 1985. - The relationship between age and blood constituents of *Barbus xanthopterus* (Heckel) in the different seasons from Sadat Al-Hindia, Iraq. *J. Biol. Res. Centre*, 17 (1) : 77-86 (In Arabic).
- HOUSTON A.H. & M.A. DEWILDE, 1971. - Some observations upon the relationship of microhaematocrit values to haemoglobin concentrations and erythrocyte numbers in the carp (*Cyprinus carpio*) (L) and brook trout, *Salvelinus fontinalis* (Mitchill). *J. Fish Biol.*, 4 : 109-115.
- JAVID M.Y. & K.P. LONE, 1973. - Haematology of fishes of Pakistan. *Acta Physiol. Latinoam.*, 23, 396-402.
- KORZHUEV P.A., 1962. - Methods of study of blood in fish. In: Rukovodstvo pomelodike issledovaniya fiziologii ryb (Techniques for the Investigation of fish Physiology). (Pavlovskii, E.N., Ed.) pp 2-10. Jerusalem: Israel Program for Scientific Translations.
- LARSEN H.N. & S.F. SNIESZKO, 1961. - Comparison of various methods of determinations of haemoglobin in trout blood. *Prog. Fish Cult.*, 23: 8-17.
- LARSON A., JOHAN-SJOBECK M. & R. FANGE, 1976. - Comparative study of some haematological and biochemical blood parameters in fishes from the Skagerrak. *J. Fish Biol.*, 9 : 425-440.
- LENFANT C. & K. JOHANSEN, 1976. - Gas exchange in gill, skin and lung breathing. *Respir. Physiol.* 14, 211-218.
- MEADE T.L. & S.J. PERRONNE, 1980. - Selective haematological parameters in steelhead trout, *Salmo gairdneri* Richardson. *J. Fish Biol.*, 17 : 9-12.
- PANDEY B.N., PANDEY P.K., CHOUBEY B.J. & J.S. DATTA MUNSHI, 1976. - Studies on blood components of an air-breathing Siluroid fish, *Heteropneustes fossilis* (Bloch) in relation to body weight. *Folia Haematol.*, Leipzig, 103 (15) : 101-116.
- PUTNAM R.W. & R.W. FREEL, 1978. - Haematological parameters of five species of marine fishes. *Comp. Biochem. Physiol.*, 61A : 585-588.
- RADZINSKAYA L.I., (1966). - Changes in the blood indices of juvenile and spawning Neva salmon (*Salmo salar* L.). *Vop. Ikhtiol.*, 6 : 568-572.

- SIASKPERE O.K., 1985. - Haematological characteristics of *Clarias isheriensis* Sydenham. *J. Fish Biol.*, 27 : 259-263.
- SMITH L.S. & G.R. BELL, 1964. - A technique for prolonged blood sampling in free swimming salmon. *J. Fish. Res. Bd. Can.*, 21 : 711-717.
- SMITH L.S. & G.R. BELL, 1967. - Anesthetic and surgical techniques for Pacific salmon. *J. Fish. Res. Bd. Can.*, 24 : 1579-1588.
- WELLS R.M.G., ASBY M.D., DUNCAN S.J. & J.A. MACDONALD, 1980. - Comparative study of the erythrocytes and haemoglobins in nototheniid fishes from Antarctica. *J. Fish Biol.*, 17 : 517-527.

*Reçu le 02-10-1986*

*Accepté pour publication le 10-03-1987*